

TECH VIBE

INVENTE 4.0

13th, 14th SEPTEMBER 2019



CONTENTS

EDITORIAL	3
MEET THE TEAM	4
PRESIDENTS DESK	5
PRINCIPAL'S DESK	6
DEPARTMENT BULLETIN BOARD	7
CURRENT TRENDS	11
RECENT ADVANCEMENTS	22
PROJECTS	47
RESEARCH	56

Editorial

Brazil's environmental minister, Ricardo Salles attributes the recent Amazon wildfire to dry weather and windy conditions while eminent meteorologists across the world claim the fire originated as a result of human intervention. The crux here is that our planet is deteriorating every second, irrespective of the cause or origin of the problem. The recent Amazon wildfire is just the tip of the iceberg and as a civilization we face looming threats from all angles, be it water scarcity, loss of greenery or even health complications.

Emphasis on technology, innovation, creativity is approaching its summit in the 21st century and as you read through this, something revolutionary and path-breaking is being discovered or invented in some corner of the world. Despite all this wealth of knowledge and resources, why are we still unable to conserve the flora and fauna we see around us? Is it just that we are unable find a solution or are we that callous about nature? The innovations and technological advancements that we glorify actually exacerbate the situation rather than help our cause. It transcends all the way from electronic production and disposal to recent farming techniques that are being followed.

Let us start taking responsibility for our actions and begin giving back to the environment. As engineers, we must learn to sensitize others about the dangers that lie ahead and also bring out solutions for the crisis at hand.

“Sustainable Innovation” is the need of the hour and its promulgation is vital towards satisfying the needs of the future generations. In the words of the great physicist, Albert Einstein, “We cannot solve our problems with the same thinking we used when we created them.”

*Vinaya Krishna
Saran Prasanth R. R.
Editors, Tech Vibe 2019*

Meet the Team

Editors:

- o Vinaya Krishna
(Mechanical)
- o Saran Prasanth R R
(Mechanical)

Faculty Advisor:

- o Dr. Sunita Nair

Department coordinators:

- o Hariny G, CSE
- o Akshara Kannan, IT
- o Kavya V Kannan, BME
- o J. Gokul Krishna, Civil
- o Shriram M K, Chemical
- o Jakkula Divya Tej, ECE
- o Harshini, EEE

Department Presidents:

- o Logesh B, CSE
- o Narayanan, IT
- o Aravind, BME
- o Sooraj, Civil
- o Shriram, Chemical
- o Sai Kiran, ECE
- o Nishanth, EEE
- o Navaneeth, Mechanical

Design Team:

- o G S Karthik Narayanan
- o Andrew Martin
- o Sharath N Chittaragi
- o Hyadarani Jayadharan
- o Hayagreev S

From the President's Desk

*Dr. Kala Vijayakumar
President
kala@ssn.edu.in*



One of the primary objectives of SSN is to create well rounded graduates who are able to give back to society. SSN focuses on the holistic development of the students. The students are encouraged to excel in all facets such as academics, research, co-curricular activities, extra-curricular activities, sports, entrepreneurship, social service among other areas.

Invente, the annual symposium, is organised completely by the students to showcase the exemplary co-curricular achievements and encourage knowledge transfer among the student community in India. This national level event is conducted for two days and offers a remarkable platform for young minds to connect with each other over co-curricular events. It is an aggregate of scientific thinking and innovation.

Over the years, Invente has established itself as one of the premier tech fests in the country with students from all over the nation looking forward to it every year. It is a combined effort from 8 engineering departments of SSN. With over 50 events and four workshops, Invente serves as a hub for millennials to explore and understand technology and its advancement. Events such as these also help in the development of organisational skills of the students and I strongly believe that this is one of the best learning experiences for them.

I wish all the students, participants, organisers and others involved with Invente 2019, all the very best and hope all the participants take back fond memories of SSN and lifelong friendships.

Dr. Kala Vijayakumar

From the Principal's Desk

*Dr. S. Salivahanan
Principal
salivahanans@ssn.edu.in*



Sri Sivasubramaniya Nadar College of Engineering provides quality education and it is the best at serving the needs of the society, by graduating talented engineers with sound knowledge, high quality research and breakthrough technologies, and emphasizing on 360 degree development of each student, making them stand out from the crowd in all aspects.

In today's world, critical thinking and problem-solving skills are as important as content knowledge. The college conducts a range of events from social awareness to international programs, to impart life skills, competencies and attributes which are greatly valued in today's global work environment.

The students of SSN CE are delighted to organise one of the best National Level Technical Symposia, INVENTE 4.0 on 13 & 14 September 2019. In its fourth edition, INVENTE aims at bringing out the technical prowess of students by providing a challenging environment with a diverse variety of events and workshops across genres, catering to the huge number of young and talented minds. It will provide a platform to witness one of the most beautiful and ground breaking amalgamations of Science and Technology with pure delight and enthusiasm.

I extend a very warm welcome to all the students to participate in this amazing Techfest. I sincerely wish this technical symposium a grand success.

Dr. S. Salivahanan

From the Department Bulletin Board

Department of Electronics and Communication Engineering

It truly is a matter of great pride and privilege for me to greet you as the Head of the Department of ECE. Invene 4.0 is a national level technical symposium organized by the Association of Engineers, SSN College of Engineering, Chennai.

The technical extravaganza has grown steadily in popularity over the years and carved a niche for itself at the national level as a reputed forum for student interaction. A plethora of exciting and challenging events like paper presentation, project exhibition, hackathon, technical quiz and E-treasure hunt have been planned as part of this symposium to bring out the best from students across the nation and enable a fun out-of-classroom learning. The extravagant technical fest which has been a host to innovative and well-organized series of events, organized to inculcate finer qualities into the student fraternity has been well captured in this edition of the symposium magazine.

The success of Invene 4.0 depends completely on the talented efforts of the students and enthusiastic motivation of faculty. I acknowledge my deepest appreciation to all who have worked untiringly and incessantly for the success of Invene 4.0. I sincerely wish that they would continue to stimulate and preserve this rich tradition of this phenomenal event in the years to come!

*Dr. S. Radha
Head of Department
Electronics and Communication Engineering*

Department of Electrical and Electronic Engineering

The Association of Electrical and Electronics Engineers of the Department of EEE is proud to be part of SSN Invene 4.0, a intercollegiate technical symposium. On this occasion, it gives me immense pleasure to pen a few words about this event. Symposiums serve as a diverse platform for exchange of technical ideas and open the doors for learning and interaction. Invene is conducted keeping in mind of the above viewpoint and provides a great opportunity for students to exhibit their prowess and talent as participants and organizers. I appreciate the faculty and students for their contribution to Invene 4.0 and in coordinating the events of this symposium. As the saying goes “Coming together is a beginning; keeping together is progress; working together is success”. Hope that we score higher and better in all the endeavors. At this juncture, I would like to extend my heartfelt wishes for the success of this event.

*Dr. V. Kamaraj
Head of Department
Electrical and Electronic Engineering*

Department of Civil Engineering

It is my pleasure to welcome you all to the technical symposium Invente 4.0, a platform that nurtures interest in students and offers them an opportunity to demonstrate their skills. Invente also facilitates cross-disciplinary interaction among students and kindles their ability to work as a team. We are pleased to introduce new events like ‘Solve-it-aire’ and ‘Word Rush’ in addition to last year’s events. A workshop on ‘STAAD.pro’ has also been planned. We hope to reach greater heights with this year’s edition of Invente.”

*Dr. S Ramana Gopal
Head of Department
Civil Engineering*

Department of Mechanical Engineering

It is with immense pleasure and great pride that we welcome all of you to INVENTE. This National level technical symposium will be a platform to evaluate your technical knowledge and creativity. It will also be one major step towards skill development and learning. I hope INVENTE 4.0 proves to be a nurturing ground for young talent and a forum for interaction and inspiration.

*Dr. V.E.Annamalai
Head of Department
Mechanical Engineering*

Department of Computer Science and Engineering

I am extremely happy to see that our students are rolling out yet another edition of the joint national level technical symposium, INVENTE. Acquiring inter-disciplinary skills seems to be the most crucial requirement in today's changing technological landscape. INVENTE serves as a forum for students to look beyond their respective disciplines and think about creative and innovative ways of combining the knowledge from multiple disciplines to solve scientific/societal problems of significance. In addition, the symposium nurtures leadership abilities and team playing skills too. I appreciate the technical team for introducing Tecathlon and the U'n'I events this year. Some of the non-technical events such as Meme Time and SciTech Quiz are also grabbing the attention. I congratulate the whole team for their efforts and wish the event every success.

*Dr. Chitra Babu
Head of Department
Computer Science and Engineering*

Department of Chemical Engineering

It gives me immense pleasure to note that the group of my Chemical Engineering students are organizing the National Level Technical Symposium INVENTE during 13 & 14 September 2019. The two full days will be dedicated to technical presentations, and non-technical events such as auto chem, chem connexions, mind hunter etc.

Participants will be able to know about the recent techniques and approaches in the multidisciplinary workshop and technical sessions.

I encourage the students to take advantage of the diverse social and technical events that had been planned to foster your personal growth and career exploration.

I wholeheartedly wish and hope that INVENTE 2019 will provide an opportunity for the student community to interact with fellow students and advance the presentation and teamwork skills.

*Dr. R. Parthiban
Head of Department
Chemical Engineering*

Department of Information Technology

Invente has been and will always be the pride of SSN, bringing together the rich faculty and student communities to work in harmony. Organizing this mammoth technical festival on a national scale is no small task, with the innovative ideas behind each event providing a whole new world of fresh perspective and dimension to students.

With best wishes to the team and its participants, I hope this Invente culminates in a grand display of technical prowess, sending home students with provocative ideas to reflect upon!

*Dr. T. Nagarajan
Head of Department
Information Technology*

Department of Biomedical Engineering

Biomedical engineers have long been a driver of advances in healthcare. With the advent of new technologies to diagnose and treat some of the most complex disease and advances that improve quality of life for everyone, the work taking place in labs around the world right now is likely to change the face of healthcare in both the short- and long-term future. The biomedical department in SSN is striving for the same with their nascent research in various domains by curious minds involving in socially relevant product developments to better the lives of the needy. The tech fest of the college has been one of its kind, continuously promoting the thirst for such stimulating knowledge and power. It gives me immense pleasure in bringing together the fraternity of technicians for INVENTE 4.0. Biomedical engineering being a multi disciplinary field, technical meets as this would be a great opportunity for researchers to invent new innovations. This symposium encompasses not only the technical critique in you, but appreciates your passion, mastery and team work. In continuum to the leaps the various departments have moulded, the Department of Biomedical Engineering resonates its success through the number of patented projects, bringing in new technology- Virtual Reality, 3D Printing and many more. We present to you, a new conjunct fixture for "Reinventing the Engineer in you"- GIZMO WIZARD, this Invene along with a riveting workshop - PCB DESIGNING USING ALTIUM DESIGNER.

Wishing success like everytime for this action- packed learning episode.

*Dr. A. Kavitha
Head of Department
Biomedical Engineering*

Advisor of Student Affairs

INVENTE is designed to challenge students with real world problems and encourage daring ideas and innovative solutions. It guarantees two fun-filled days of intellectually stimulating contests, challenging workshops and seminars. Behind the two-day symposium lies months of co-ordinated efforts and planning by students of SSNCE. It takes varied skill and ability, acquired from experiences such as this, to organize a conglomeration of thrilling events that promises a very unique and interesting experience to our participants.

*Dr. Sunita Nair
Professor, Department of Chemistry
Advisor of Student Affairs*



Department of Electrical and Electronic Engineering

Future of Electrical Engineering

For the past couple of decades or so, the science pertaining to the amalgamation of the various fields of technology has taken a great stride in ensuring the betterment of the quality of life while also attempting to reduce the burden of technology on the environment. Since the advent of the computers by Charles Babbage, the computational time has been reduced manifold and thus, the productivity and extent of scientific discovery has further been exemplified. The trends in engineering have ever since been inclined to its application with the help of a computer.

Electrical Engineering too, has and is witnessing the aforementioned trend in all its grandeur. Various software applications have emerged which possess the functionality to solve even the most trivial of problems, accurately and quickly. Nowadays, the fault in a system can be detected remotely without the tiniest bit of hassle and can be rectified with less difficulty.

Trends related to application are clearly biased to the field of computers. However, on the overall, the current trend pertains to the development of sustainable energy sources using renewable and non-conservative sources of power. Thus, it can also be said that the generation of Power is still the current trend in Electrical engineering, as it has been for centuries. The generation, however, as mentioned before is being shifted to the expanse of renewable power due to dwindling resources and the impact of these conservational sources of energy on the environment. This need to shift to renewable power has been accentuated at every international political summit for a decade now, but progress has been slow. This can be associated with the fact that the shift to renewable energy requires significant amount of changes at every stage of its application. There are however, ideas being put forward to minimise the changes required at every level and implementation. Once the research pertaining to this shows promising outcomes, the shift will gather impetus and the once indolent countries will be obligated to put this scheme into action. In addition to this, the fields of Communication technology and Control systems are very much in the viewpoint of many of the researchers working in the field of Electrical Engineering.

Advancements in recent times in the field of electrical engineering are innumerable and most of them are laudable. From higher efficiency photovoltaic cells to Smart Electrical Grids to Power Exchange between countries to extremely high speed Wi-Fi, electrical engineers are breaking most of the barriers set by itself previously. The fact that these advancements range from the most commonplace of things to crucial breakthroughs is indeed astounding. For example, a simple wireless charger has now found its way into most homes, which was previously for very specific brands only.

There exists great potential among the students of engineering to widen the prospect of technological development in the world. The learning curve, if emphasised on steering the students in the undergraduate or graduate level towards the field of research, industrial or academic can greatly improve the momentum of useful research in the field of engineering. Simple, but meaningful projects can go a long way in solving some key issues. Solving trivial problems in the beginning can go on to set a trend in the future that is looked up to by the students of the successive generations.

- Adithya Pillai, EEE , IV Year

Department of Information Technology

Scranos - the evolving modular rootkit malware

With enough technology awareness inducing malware hits like WannaCry ransomwares in the past year, new powerful rootkit – enabled spyware now comes in to set the new limit in 2019. Donning the name Scranos (Wonder where it came from), whose preliminary roots were discovered last year, is described by experienced hackers as “A work in progress”.



Conventional Rootkit malwares have always been existing for the past decade but what sets this out from the other malwares is the undesirable fact that it is constantly evolving, unlike all the malwares which usually exploits a few pre-discovered vulnerabilities and could be handled rather easily, making it significantly harder to detect and prevent it from damaging the system and user's files. It is continuously evolving, being tested and fitted with new components and regularly making an improvement to old components, which makes it a significant threat.

Scranos features a modular design that has already gained capabilities to steal login credentials and payment accounts from various popular services, exfiltrate browsing history



and cookies, get YouTube subscribers, display ads, as well as download and execute any payload. According to a 48-page in-depth report Bitdefender shared before, the malware gains persistence on infected machines by installing a digitally-signed rootkit driver (which gives the malware access to the computer components).

Researchers believe attackers obtained the valid digital code-signing certificate fraudulently, which was originally issued to Yun Yu Health Management Consulting (Shanghai) Co., Ltd. and has not been revoked at the moment. It is believed that the rootkit registers a start-up service to invoke it back whenever it senses that the system is shutting down allowing for its persistence by modifying the registry of the system it infects (Usually windows). Upon infection, the rootkit malware injects a downloader into a legitimate process which then communicates with the attacker-controlled Command-and-Control (C&C) server and downloads one or more payloads.

What is relatively and is a big surprise is the modularity the root kit malware provides. A potential attacker can use the payload and modify it so that it affects only the services that intended to be hit, making it versatile in function and harder to detect by anti-virus software by changing its behaviour signature.

Many payloads were identified at the time of writing. A few payloads have been listed below.

- Password and Browsing History Stealing Payload — The main dropper steals browser cookies and login credentials from Google Chrome, Chromium, Mozilla Firefox, Opera, Microsoft Edge, Internet Explorer, Baidu Browser and Yandex. It can also steal cookies and login info from victims' accounts on Facebook, YouTube, Amazon, and Airbnb.
- Extension Installer Payload — This payload installs adware extensions in Chrome and injects malicious or malware-laden ads on all webpages users visit. A few samples also found installing fake browser extensions, such as Chrome Filter, Fierce-tips and PDF Maker.
- Steam Data Stealer Payload — This component steals and sends victims' Steam account credentials and information, including the list of installed apps and games, as well as hardcoded version, to the attacker's server.
- Another surprising fact about the rootkit malware is that it can even interact with various websites on the behalf of the victim. The root kit malware is no longer restricted to accessing the victim's local files but also their online internet presence as well. Some of the online payloads have been listed below.
- YouTube subscriber payload — This payload manipulates YouTube pages by running Chrome in debugging mode, instructing the browser to take various actions on a webpage like starting a video, muting a video, subscribing to a channel, and clicking ads.
- Facebook Spammer Payload — Using collected cookies and other tokens, attackers can command malware to send Facebook friend requests to other users. It can also send private messages to the victim's Facebook friends with links to malicious Android APKs.
- Android Adware App — Disguised as the legitimate "Accurate scanning of QR code" app available on Google Play Store, the malware app aggressively displays ads,



tracks infected victims and uses same C&C server as the Windows malware.

The list is obviously not exhaustive. According to the telemetry gathered by Bitdefender researchers, Scranos is targeting users worldwide, but “it seems more prevalent in India, Romania, Brazil, France, Italy, and Indonesia.”

Events like these call for cautioned usage of the internet and it may not be far until the anti-viruses we trust on, may no longer be able to protect from the malware that's developing day by day.

- Sri Hari Karthick N, IT , IV Year

Department of Computer Science and Engineering

Robot Dexterity

Robot dexterity will be the next big breakthrough in smart machines, while drones and driverless cars dominate the headlines, robot dexterity is likely to have an even greater impact in both business and everyday life. The word “dexterity” means the ability to perform a difficult action skilfully and quickly with hands. The word “dexterity” is thrown around a lot in the robotics world. It’s used by robot manufacturers who describe their robots as dexterous. It’s used by gripper manufacturers who describe their grippers as dexterous.

Robots working alongside humans, and supplanting certain tasks, is not a new phenomenon. If you tour any manufacturer facility, you will see large robotic arms performing a variety of actions, from lifting and holding materials to bolting and welding them into place. Each robot is programmed to do a particular task or set of tasks. However, the ability to interact with a diverse set of objects, or to operate with a diverse set of skills, has previously evaded robotics technology. These are the primary barriers that have stood between robots and tasks that require fine motor skills. In the past, robots were confined to assembly line-type jobs, completing repetitive tasks. New programming and designs are enabling robots to perform more complex, specific tasks that require improved dexterity.

Use of polymer that can expand and apply the proper amount of pressure to specific objects allows new robots to grasp and lift things their predecessors could not. Adding to this, Artificial Intelligence helps robots to process information, such as data provided by cameras, to assess the type of object and its location, allowing them to adjust on the fly. Recent advances in machine learning, large Data and robotic perception have put us at the threshold of a quantum leap in robot ability to perform motor-related tasks and function in uncontrolled environments, thus improving their performance and increasing their productivity.

The researchers used a technique called reinforcement learning in which the robot learns via trial and error. They created a simulated world in which the robot could practice picking up and manipulating objects in virtual reality. When the robot did what the

researchers wanted like grabbing an object from a pile or placing the object back in its position or etc., it was given a reward. This technique allows the robot to master skills in a virtual environment and then apply them to the real world.

A major advance in depth perception was also essential for robots to work in an uncontrolled environment. Previously, they could only see the world as a flat field of seemingly random colours. But with this new 3-D perception, they could identify individual objects in a crowded field. While vision is an excellent tool for guiding broad movements, fine motor skills require a sense of touch and objects positions. Dexterous robot hand uses three standard RGB cameras to predict the position and orientation of the object lying on its palm. The neural network inside the system only observes the co-ordinates of the fingertips and images from the camera to balance the object.

Dexterity creates new opportunities

Imagine a robot that can do things with its hands in the real world—anything from defusing a bomb to doing your laundry. This has been a dream in the research community for decades, but now we're finally getting to the point where it could actually happen.

The extensive programming is required to enable robots to perform specific tasks, though expensive, provide unparalleled opportunities for growth, both technologically and financially. There has been significant improvement in this field. Robert Platt (computer science professor at head of the Helping Hands robotics lab at North eastern) in collaboration with the University of Massachusetts Lowell and the Crotched Mountain Rehabilitation Facility in New Hampshire, is building a power wheelchair with a robotic arm that can grasp items around the house or perform simple household tasks. This could enable elderly or people with disabilities to continue to live independently in their homes.

Engineering professor Hanumant Singh in collaboration with Platt are building a golf-cart sized mobile robot equipped with a robotic arm that can drive around Northeastern's campus autonomously and perform simple manipulation tasks like taking out the trash and cleaning the surroundings.

Robotic surgery is the process whereby a robot actually carries out a surgical procedure under the control of nothing other than its computer program. Although a surgeon almost certainly will be involved in the planning of the procedure to be performed and will also observe the implementation of that plan, the execution of the plan will not be accomplished by them - but by the robot. National Science Foundation has funded to create a robot that can perform MRI-guided surgery. Dexterity plays a major role in this, as it would require fine motor skills to perform such major surgery.

But it's not all doom and gloom for humanity and its workers. While a robot may

replace a worker or two in a facility, their implementation will also create new jobs. From designers and programmers to mechanics and trouble-shooters, the deployment of robotics will require humans to keep them running smoothly and efficiently. Beyond this encouraging fact, the human hand is still the most adaptive tool on the planet, and will not soon be replaced. While engineers are working hard to make robots more adept at performing delicate tasks, it will be many years before a machine can fully replace humans in the workplace.

- Nafisa Saida H, CSE , IV Year

Industry 4.0

Industry 4.0 – is the latest wave of a series of advances in technological innovation that have transformed manufacturing industries over the last 250 years. For manufacturing companies, this means improved efficiency and flexibility – even the advent of previously unattainable capabilities. Starting around the year 1760, the First Industrial Revolution started human society's transformation from a muscle-powered, largely agrarian way of life to the highly mechanized world we currently live in. Then, it was water and steam power replacing human and animal power which enabled the mechanization and thus the transformation. The second wave was electrical power, then came computers – and now it's the industrial realization of a potent combination of data gathering, data interpretation, data manipulation, inter-machine communication, and revolutionary new manufacturing methods.

Industry 4.0—the combination of digital processes such as the Internet of Things (IoT), automation, robotics, and additive manufacturing—has a disruptive impact on mechanical engineering design. Not only do engineers need to redesign processes and operations to accommodate these new advances, Industry 4.0 impacts how they design products for increasingly smart manufacturing facilities. This allows them to make higher-quality products more efficiently and react more quickly to shifting consumer demands, building customer loyalty and gaining market share. Despite the buzz around Big Data, AI and IoT (Internet of Things), it is necessary to realize that Industry 4.0 in its truest sense is a manufacturing revolution and by that very nature, its successful implementation and evolution will hinge greatly on mechanical engineers (their skills, adaptation to digitization and innovative approach). To give you a simple and general perspective, the role of mechanical engineers will not only be crucial in the “smart factory”, it will expand and encompass a diversity of tasks and roles that may differ from the traditional job descriptions in the field today. In an era where interdisciplinary teams are becoming more and more important to the integrated design and manufacturing model, Industry 4.0 holds the promise of the ultimate teamwork across functional boundaries between design, procurement, manufacturing, and post-sale service.

The Industry 4.0, is not only a new generation development in Industry technology, it

talks about the advanced Industrial revolution process in different fields. It explains the new information, principles, risks and challenges to overcome the competitiveness in the industry. This new technology improvement used in different fields like design, production and manufacturing is also applied to digital revolution. Industry 4.0 will deliver greater flexibility and robustness together with the highest quality standards in engineering, manufacturing, planning, and operation and logistics processes. To transform ourselves into the “Engineer 4.0”, ready for the next round of manufacturing innovation, we must investigate, adapt, and optimize. Investigation is the beginning of our practical steps keeping ourselves and our companies from being left behind. Each engineer has a relevant field and a relevant manufacturing niche. Investigation is key in determining which Industry 4.0 technology will be advantageous to you and your workflows. Once we have investigated and identified how our industry can benefit and will shift through Industry 4.0, actively adapting ourselves to this connected climate will allow us to stay relevant – perhaps even grow into significance if we aren’t already. Lastly, as with every engineer’s workflow, we have to optimize our innovation. Initial innovation usually is found somewhere in the “desirable” and “possible” realm. It is our job as engineers to shift it upward to the “required” range. If we optimize new connected technology into the “required” category, we are seen as innovators and are readily prepared.

- Vignesh Muthu Kumaran, Mechanical , IV Year

FACTS

A factory with no human labor is called a Dark Factory. This is one of the recent technologies that industries are following, which is an outcome of the Industrial Revolution 4.0

2019

RECENT
ADVANCEMENTS
IN TECHNOLOGY

WiTricity is developing the technology for use at charging centers for electric vehicles (EVs) using the wireless charging technology that we use in phones. EV drivers can now pull into a spot in a parking garage and receive power without plugging in using this tech.

FAC | S

The Smart Grid

Everyone would have definitely heard the term “smart grid” in the news or from electricity providers. But not everyone knows what the grid is, let alone the Smart Grid. “The grid,” refers to the electric grid, a network of transmission lines, substations, transformers and more that deliver electricity from the power plant to your home or business. It’s what you plug into when you flip on your light switch on your computer. The electric grid is considered as an engineering marvel. To move forward, we need a new kind of electric grid, one that is built from the bottom up to handle the groundswell of digital and computerized equipment and technology dependent on it—and one that can automate and manage the increasing complexity and needs of electricity in the 21st Century.

What makes a grid smart?

In short, the digital technology that allows for two-way communication between the utility and its customers, and the sensing along the transmission lines is what makes the grid smart.

Like the Internet, the Smart Grid consists of controls, computers, automation, and new technologies working together to respond digitally to our quickly changing electric demand.

Why smart grid?

The smart grid represents an opportunity to push the energy industry to be more reliable and efficient, and catering to the economic and environmental development. Smart grids ensure more efficient transmission of electricity, quicker restoration of electricity after power disturbances, integration of large-scale renewable energy systems, etc.

Today, an electricity disruption such as a blackout can have a domino effect—a series of failures that can affect banking,

communications, traffic, and security. A smarter grid will add resiliency to our electric power system and allow it to address emergencies such as severe storms, earthquakes. Because of its two-way interactive capacity, the Smart Grid will allow for automatic rerouting when equipment fails or outages occur. When a power outage occurs, Smart Grid technologies will detect and isolate the outages, containing them before they become large-scale blackouts. The new technologies will also help ensure that electricity recovery resumes quickly and strategically after an emergency—routing electricity to emergency services first.

Personalising the smart grid

The Smart Grid is not just about utilities and technologies; it is about giving you the information and tools you need to make choices about your energy use. If you already manage activities such as personal banking from your home computer, imagine managing your electricity in a similar way. A smarter grid will enable an unprecedented level of consumer participation. “Smart meters” will allow you to see how much electricity you use, when you use it, and its cost. Combined with real-time pricing, this will allow you to save money by using less power when electricity is most expensive.

Building the grid

The Smart Grid will consist of millions of pieces and parts—controls, computers, power lines, and new technologies and equipment. It will take some time for all the technologies to be perfected, equipment installed, and systems tested before it comes fully on line. The Smart Grid will likely bring the same kind of transformation that the Internet has already brought to the way we live, work, play, and learn in the next decade.

- Deekshitha, EEE , II Year

Smart Shoes

Cutting the cords

Have you ever had the moment where you had to send an important message to a person and your phone battery goes dead. It would indeed be a pretty irksome moment. What if I say your phone battery can charge on its own while you are walking. Yes, it is possible by piezo electric energy harversting - the cord free technology.

This method is based on the law of conservation of energy that energy can neither be created nor destroyed, but it can only be transferred from one form to another. This technology simply involves a pair of jogging shoes which senses mechcanical pressure or strain while we are walking and converts it into electrical energy.

In the jogging shoes, four piezoelectric sensors are connected in parallel that are fitted in to the sole of the footwear. During jogging and jumping, mechanical stress that is applied on the sole of the footwear is converted to electrical voltage which is given to the electronic gadget. To get maximum output from the sensor, it has to be set in its self-resonant frequency range. The voltage produced by the sensors is AC which has to be converted to DC for charging mobiles which has constant DC battery. Hence, bridge rectifiers are used for conversion. The load that is used for storing the harvested electrical energy is the mobile phone battery. A human while walking exerts about 30W of power on the ground and theoretically out of which 100mW of electrical power is possible to obtain without disturbing the comfort of the person's walk which is quite sufficient for charging phones.

Piezoelectric energy is one of the cleanest form of alternate energy source. So far this technology is still in its infancy. There is plenty of time and space for young scientists to come up with new ideas for a cord-free future.

- G.S.Soundhariya, EEE , III year

Biomimicry

Are you afraid of snakes? What about robots? What about snake robots?

Now here's one among those new innovations in artificial Intelligence with a disruptive line of thought. Since their inception, robots have always been an imitate of human or humanoid structures. If a robot can be built to look similar to a human being, researchers have hit on a disruptive thought as to why such a robot can't be built to look like any other creature. While exploring new ways to monitor structural defects in infrastructure, machines which are as small and flexible are much needed at this point. Robots which are nimble, can find their way into applications including but not limited to fragile search missions, minimally invasive surgery etc.



Automated machine-creatures, which were brought to life using artificial intelligence and robotics, can be used to combat life threatening circumstances. This idea isn't entirely new to us; we have been seeing such machines in Sci- fi movies such as Antman and Spiderman- Far from Home, with automated ants and spiders crusading their way into the villain's lair. Nature has and will always be mankind's best teacher. Providing enlightening ideas and brilliant concepts to be incorporated into our daily lives. That's essentially what the new field of science I mentioned – called "Biomimicry", or in professional circles, "Biomimetics" – is all about.

- Swathi ganesh, IT , IV Year

Sixth Sense

We've all seen sci-fi movies with cool futuristic technology and wondered how amazing it would be to actually use that technology in everyday life. The holographic display of computer screen, commands given by gestures, the smart digital assistant that talks to us and so on. What if I told you all this could be true in the very near future? Few years ago, this might have sounded ridiculous, but now thanks to the researchers at MITmedia lab, this could be our new reality.

'SixthSense' is a wearable gestural interface that augments the physical world around us with digital information and lets us use natural hand gestures to interact with that information. It is an amalgamation of various technologies like Augmented Reality, gesture recognition, image capturing, processing, and manipulation, etc. It integrates the real world with the digital world.

Us humans have five basic senses: touch, sight, hearing, smell and taste. The sensing organs associated with each sense send information to the brain to help us understand and perceive the world around us. But with the growth of technology, we don't get the information from just the physical world. A large chunk of our information is something that can't be understood and perceived by our biological senses. It's all in digital form. Though we use various devices to interact with it, we don't communicate directly and naturally to the digital world as we do with the real world. The sixth sense technology is all about interacting with the digital world in most efficient and direct way. It acts as a gateway between the tangible and the intangible world.

Steve Mann is considered as the father of Sixth Sense technology who made a wearable computer in 1990. He implemented the Sixth Sense technology as the neck worn projector with a camera system. Then his work was carried forward by Pranav Mistry, an Indian research assistant in

MIT Media Lab.

The sixth sense prototype consists of a pocket projector, a mirror, mobile components, color markers and a camera, all fabricated as a pendant. The projector projects the computer screen onto any surface be it a wall or your own hand. When the user moves their hands to form different gestures, the camera captures these movements with the aid of the colour markers on their fingertips. All the components are controlled by the mobile computing device in the user's pocket.

Gestures are how we communicate in the real world. We know that if someone shows you a thumbs up, then it means good and a thumbs down is bad. That's the basis of this technology as well. Each gesture has a meaning behind it and are tracked using the colour markers and the camera. For example, making a square with your hands would click a picture and the action of turning your wrist to look at the time would project a watch on your wrist.

This has widespread applications ranging from helping make human-humanoid interaction more efficient to acting as a replacement to the 5 human senses for disabled people. This would not only help us overcome the divide between the digital and physical world, but will also help us stay human and be more connected to our physical world. It ensures to an extent that we don't become machines in front of machines.

- Sanjana Sukumar, IT , III Year

Wait! My phone actually bends!

With today's technological advancements, it is true that Science fiction is getting closer to fact. Many new gadgets are being created. Some of them that came out recently include Pilot Wireless Headphone Translators, Port Solar Charger, Aqua Treadmill, Bendable or Flip Phone and so on. In this discussion, we will get deep into the nuances of flip phones and what is making it possible. In contrast to the flat surfaced phones, these will flout the existing tradition.

Back in November, just days before Samsung teased its flexible display phone, Royole burst onto the scene with the Flexpai, the world's first bendy phone. Unlike Samsung's teaser, the Flexpai isn't a prototype, it's something you can buy right now.



"As I travel about, I see all kinds of surfaces around me and imagine them as screens," says Paul Cain, strategy director at flexible-electronics firm FlexEnable.

The organic light-emitting diodes (OLEDs) in these displays emit their own light, and as a result, they don't need a backlight. This means they can be affixed to thin lightweight materials, including plastic. As the performance and efficiency of these OLEDs improved over the last decade, giants of the technology industry such as LG, Apple, Samsung and Sony have trialled their own flexible display technology.

Now the question that will arise will be 'Why would I even



want my gadget to bend?' One important factor will be durability. Devices with glass screens are inherently fragile, and this method makes them less susceptible to damage.

When compared to Samsung, Royole has stolen a bit of its thunder with its very own flexible display device. Called the FlexPai, the 7.8-inch hybrid device can fold 180 degrees and transform from a tablet into a phone, albeit a bulky one. When we consider the specs of this device, it has a 2.8Ghz, eight-core Qualcomm Snapdragon processor, the display resolution is 1920 x 1440 when fully expanded, and it comes with a 3,800 mAh battery.

It is true that every once in a while, a new technology, an old problem, and a big idea turn into an innovation. Technology has forever changed the world we live in. We're online, in one way or another, all day long. Our phones and computers have become reflections of our personalities, our interests, and our identities. They hold much that is important to us.

- Harini Balasubramaniyam, ECE , IV Year

A Visible Light Communication: Li-Fi Technology

In today's world where technological advancements are exponentially increasing, we survive, compete, and develop several machines and technologies. We as humans have always pondered upon improvement from as long as 200 years ago. In the process, we have continually made our technological environment better by the day. We are currently in the 4th industrial revolution, where machines have started communicating not only with humans but also with each other and have even established a way to identify and recognize objects on their own. Some may think mankind has already achieved so much that there are certainly no more ways of improving the system. Nevertheless, there is always room for improvement in any domain.

When it comes to the communication domain, one of the revolutionizing ideas that recently came into the picture is Li-Fi technology. Li-Fi or Light Fidelity, a term coined by the inventor Professor Harald Haas, is a wireless communication that transmits high-speed data via common household light-emitting diodes. As LEDs are light sources made of semiconductor devices, the current of electricity can be dimmed and brightened at ultra-high speeds, through the electron and proton interaction. Therefore, they can be switched on and off faster than the naked eye can detect. While the changes in the amplitude are unrecognizable to the human eye, it transmits data at rapid speeds.

The basic process is that, when data is fed to an LED lightbulb, the embedded microchip with signal processing technology detects the changes in the amplitude. This causes the LEDs to either turn on or off. Thus, allowing the data to be transmitted in binary code. A photodiode detects the light stream and transforms the amplitude fluctuations into an electric current. Furthermore, the electric signals are converted back to the binary data stream and are transmitted to a computer or mobile device, where a binary data stream runs the web, video and audio applications. Even though this

technology seems to be reliable, how is it so advantageous?

Well, there are unquestionably many advantages to this technology. First of all, light has 10000 times wider bandwidth than the radio waves which boast of better capacity. Second of all, light cannot penetrate walls and therefore provides better security. Li-Fi can be used underwater whereas Wi-Fi cannot be used underwater. Also, the Li-Fi technology when implemented, every street light in our world could be a possible data hotspot, if they're all LEDs. Last and foremost, light is eco-friendly, as it doesn't affect humans, birds, etc. whereas radio waves do. Though all of these are very futuristic and promising, it also has a few disadvantages. Firstly, light cannot penetrate through walls or any opaque material, which means it is restricted to a space confined by walls and opaque materials. Secondly, Li-Fi cannot be used in direct line of sight. Practically, these disadvantages are a bit discerning and might lead to bad judgments from the critics.



Nonetheless, scientists are constantly working on it to try and improve Li-Fi technology. The reason why this technology can be revolutionizing is that the transmission of data is through light, which travels fast. In addition to that, as stated in the advantages, every street light could be a data hotspot. In conclusion, even though people thought Wi-Fi was one of the greatest inventions of all time, it undeniably is, but is never limited to

that. There's always a possibility or scope of improvement such as Li-Fi which eventually will take over.

- Anirudh L, ECE , III Year

Algae biomass can be used for energy. Algal-based fuels can be produced five to ten times faster than many forms of land-based agriculture like corn and soy.

FAC | S

Algal Biomass - The Panacea for energy crisis and ecological conundrums

Energy requirement has been exponentially increasing of late considering industrialisation, population explosion and a number of other economic, societal and technical factors. Given this increase, it is evident that the conventional energy sources are being exhausted, by which the need for finding alternate sources of energy arises. Besides, environmental issues like global warming, ozone layer depletion and particulate matter increase are majorly caused by these traditional sources of energy- rendering the necessity of alternate energy sources more urgent. Energy and environment sector has hence gained significant attention for the past few decades in the field of research and development. Changes towards environmental improvements have been considered more and more acceptable. Eco-friendly methods of production and eco-friendly sources are the needs of the hour which in turn will enable waste minimization, pollution reduction, efficient energy generation and reduction of harmful emissions and help us move towards a greener society. These renewable energy sources on optimal and properly supervised usage decrease ecological hazards and tend to be sustainable. Solar energy, tidal energy, wind energy and biomass energy- to name a few, are renewable energy sources that have been on the rise. Renewable energy sources as listed above are said to provide nearly one fifth of the total global energy demand. Of the aforementioned ones, bioenergy has been gaining significant attention this decade in the scientific arena. Bioenergy, to put it in layman's terms refers to sources of energy obtained from biological sources. The sector of biofuels in itself is a vast area of interest, given the innumerable ways it offers to produce eco-friendly, harmless energy. Biofuels are comparatively more eco-friendly and efficient. They can be synthesised from a number of sources ranging from forestry to small scale agriculture. Researchers posit that adapting to biofuels will not only provide a solution for the energy crisis, but also help to promote a greener way of living solving issues like greenhouse effect, air pollution and so on.

However questions have been raised and arguments have been put forward on efficient management of food resources whilst attempting to produce biofuels from agriculture and forestry. Given the food crisis in underdeveloped countries, these questions put forward are valid enough to be answered. Fortunately, a major chunk of biofuels can be synthesized from biological waste (primarily of plants) or can be obtained as by-products and side products during food production. Biofuels as mentioned can be produced by innumerable methods such as but not limited to pyrolysis, anaerobic digestion, bio refining and esterification from a wide range of feedstock like algal biomass, oil crops and lignocellulosic biomass. The conversion methods, to name few- include pyrolysis, hydrothermal liquefaction and gasification. First generation biofuel sources like vegetable oils haven't proven to suffice the growing global energy demands. It must also be noted that their inefficiency has necessitated the need for development of second generation biofuel sources that offer better potentials. One of the most common arguments posited against the second and third generation fuels is based on land availability and ecological balance. Third generation biofuels have enormous potentials and there are indications that algal biomass could very well be the remedy to high demands for fuels. Given these facts and advantages, algal biomass has been a significant area of research and development. Algal biomass- a third generation biofuel resource provides the advantage of being non-edible and predominantly waste, hence nullifying the disadvantages of bioenergy deployment- food depletion, waste management and land availability. Algae offer great potentials as a biomass resource enabling production of green transport fuels and other applications like carbon capture, sequestration and pollution mitigation.

There are numerous species of algae with varying proportions of nutrients and other essentials. Case in point, nearly three fifth of Spirulina Maxima is proteins, whereas Scenedesmus has two fifth lipids. Certain green algal species exhibit high levels of hydrocarbons and lipids easily convertible to hydrocarbons like major crude. Based on their compositions one can determine the possibilities and efficiency of producing biomass from algal species. The process is majorly influenced by the presence of lipids and sugars. Micro algal species in specific prove to be more advantageous than the rest given the fact that micro algal biomass does not have time and climatic constraints as opposed to plants. Also, micro algae are easier to cultivate, requiring less water than terrestrial plants. They are also capable of neutral fat synthesis and greenhouse gas mitigation (as they absorb carbon dioxide- the amount of gas absorbed being twice the corresponding amount of algae required) Microalgae absorb ammonium ions, nitrate anion and phosphate anion from the environment that allows to consider them as the wastewater purifiers. They can be grown in conditions considered unfavourable for normal terrestrial forestry. Besides all these advantages, they have also been proven to be capable of synthesising chemical and biochemical compounds that can be used in various sectors of the industry. Researchers in the current decade have been focusing on optimizing the process and making algal biofuel production as efficient as possible. Studies have been done focusing on algal cultivation,

biomass collection, pre-treatment, conversion and purification.

Microalgae cultivation medium should contain sufficient sources not only of carbon, but also of other minerals such as nitrogen and phosphorus in significant amounts, and magnesium, calcium, chlorine, silicon, manganese, iron as traces. Microalgae cultivation media should possess high productivity and ease of parameters control (temperature, pH, O₂, turbulence reliability). The systems of microalgae cultivation can be roughly divided in two large common types: open-air systems (ponds) and close systems (photo-bioreactors). Open air systems can be further divided into raceway ponds, circular ponds, natural ponds, artificial ponds and inclined ponds whereas, photo bioreactors are classified based on the shape of the reaction medium as tubular, flat type, column type and so on. Conversion methods are classified into thermal, chemical and biochemical. Thermal conversion techniques include pyrolysis, gasification and liquefaction. Chemical method refers to trans-esterification reaction processes. Biochemical methods include anaerobic digestion and fermentation. All the aforementioned methods have advantages and drawbacks of their own. As a whole, the drawbacks are seldom major with the exception of lack of awareness, practical implementation and some economic constraints caused by the process involved. It can be stated that the third generation of biofuels is not as commercialized as conventional fuels. However, researchers suggest that a major shift towards green and renewable energy sources is impending and significant changes in trends will arise in a decade or two- provided that solutions are found for the constraints and hindrances involved.

- R Sai Jayaraman, Chemical , III Year

Bubble Deck Technology Uses Less Concrete by Filling The Slab With Beach Balls

Concrete is heavy, and 5% of the world's CO₂ is created during the manufacture of the cement that goes into it. Then there is the aggregate that is dug out and the trucks that have to carry it. Not only that, but most of the concrete that is in a slab isn't even needed; it is just a spacer between the bottom, where the reinforcing steel is in tension, and the top, where the concrete is in compression.

BubbleDeck is a really clever solution to this problem: it fills the slab with plastic balls that are held in place in prefabricated assemblies of reinforcing. It has been used a few times in Canada.

BubbleDeck is a biaxial technology that increases span lengths and makes floors thinner by reducing the weight while maintaining the performance of reinforced concrete slabs. The concept is based on the fact that the area between columns of a solid slab has a limited structural effect beyond adding weight. Replacing this area with a grid of "voids" sandwiched between layers of reinforcing welded wire steel and an internal lattice girder yields a slab typically 35% lighter that performs like solid reinforced concrete. Once the steel lattice/void "sandwich" is concreted, it is then precast into panels of various sizes and craned into position onshoring. Once the concrete is poured over the balls in the panels, the BubbleDeck system effectively becomes, and behaves like, a monolithic two-way slab that distributes force uniformly and continuously. Bubble deck claims that it produces floors 20% faster with less formwork and beams, reduces construction costs by 10% and agrees with the 35% reduction in concrete use. "Off-site manufacturing, fewer vehicle movements and crane lifts and simple installation all combine to minimize operating as well as health & safety risks.

Replacing concrete with....air. I wonder why this isn't used everywhere.

- Nijanthan S, Civil , II Year

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Billionaire Dmitry Itskov created a non-profit organization called the 2045 Initiative, where they want to make people immortal by adding human intelligence into artificial bodies by the year 2045

FACTS

Breakthroughs in Technology

Being influenced is a daily routine. You are influenced by the food you eat, the clothes you wear and the company you keep. But recently in the past few decades, a new component i.e technology has been added on to this list. Gradually climbing up the rungs to become a major influencer. Let us sit back and be fascinated by these elements of surprise and admiration.

Sensing City

We have all seen the movie I, Robot where robots are responsible for doing manual labor. A company called Alphabet's Sidewalk Labs based in New York is now working towards converting this fiction into reality. The company is collaborating with the Canadian government on the high-tech project, slated for Toronto's industrial waterfront. This project aims to make the Toronto neighborhood Quayside the first place to successfully integrate cutting-edge urban design with state-of-the-art digital technology. The plan calls for all vehicles to be autonomous and shared. Robots will roam underground doing menial chores like delivering the mail. Driverless cars will have a big role. Sidewalk assumes they will navigate more precisely and obey traffic laws more consistently than human drivers, so it wants to put narrower lanes in Quayside and carve out more room for sidewalks and parks. In theory, using shared self-driving vehicles will mean that fewer people need to own cars, saving families a projected \$6,000 a year. Sensing and monitoring public activity accurately and frequently will be key.



This company spawned in part by technologists thinks of smart cities rather like smartphones. It sees itself as a platform

provider responsible for offering basic tools (from software that identifies available parking spots to location-based services monitoring the exact position of delivery robots), much as Google does with its smartphone operating system, Android.

AI For Everybody

Artificial intelligence has so far been mainly the plaything of big tech companies like Amazon, Baidu, Google, and Microsoft, as well as some startups. For many other companies and parts of the economy, AI systems are too expensive and too difficult to implement fully. The curious common man was being deprived of AI until now as machine-learning tools based in the cloud are bringing AI to a far broader audience.

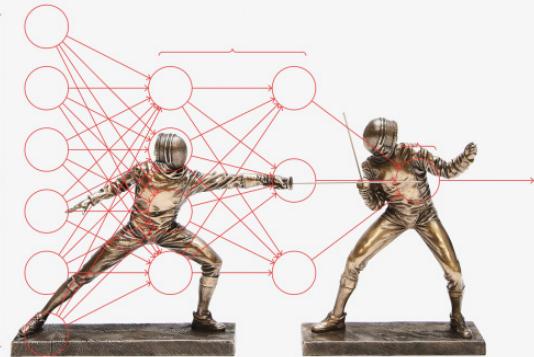


So far, Amazon dominates cloud AI with its AWS subsidiary. Google is challenging that with TensorFlow, an open-source AI library that can be used to build other machine-learning software. Recently Google announced Cloud AutoML, a suite of pre-trained systems that could make AI simpler to use. Microsoft, which has its own AI-powered cloud platform, Azure, is teaming up with Amazon to offer Gluon, an open-source deep-learning library. Gluon is supposed to make building neural nets—a key technology in AI that crudely mimics how the human brain learns—as easy as building a smartphone app. These products will be essential if the AI revolution is going to spread more broadly through different parts of the economy. Currently, AI is used mostly in the tech industry, where it has created efficiencies and produced new products and services. But many other businesses and industries have struggled to take advantage of the advances in artificial intelligence. Sectors such as medicine, manufacturing, and energy could also be transformed if they were able to implement the technology more fully, with a huge boost to economic productivity.

Dueling Neural Networks

AI is top-notch at identifying over a million images with uncanny accuracy but asking it to produce a picture is like asking it to meet its match. For eg, it can identify pedestrians but can't produce a picture of them. The problem is, creating something entirely new requires imagination—and until now that has perplexed AIs.

The solution first occurred to Ian Goodfellow, then a Ph.D. student at the University of Montreal, during an academic argument in a bar in 2014. The approach, known as a generative adversarial network, or GAN, takes two neural networks—the simplified mathematical models of the human brain that underpin most modern machine learning—



can't spot fakes. Essentially, the generator has been taught to recognize, and then create, realistic-looking images of pedestrians.

GANs have been put to use creating realistic-sounding speech and photorealistic fake imagery. GANs are beginning to understand the underlying structure of the world they see and hear. And that means AI may gain, along with a sense of imagination, a more independent ability to make sense of what it sees in the world. This gives machines something akin to a sense of imagination, which may help them become less reliant on humans—but also turns them into alarmingly powerful tools for digital fakery.

So it's time to face the consequences whatever they may be. Who knows with this discovery, we might have to bend the knee to robots.

Babel-Fish Earbuds

These earbuds have been a part of us since ages ago i.e they first appeared in the famous science fiction movie- 'A Hitchhiker's Guide to the Galaxy' where the yellow babel fish was slid into your ear to get the translation of intergalactic languages in an instant. The real-world adaptation has been achieved by Google in the form of Pixel Buds. These work with its Pixel smartphones and Google Translate app to produce a practically real-time translation.

One person wears the earbuds, while the other holds a phone. The earbud wearer speaks in his or her language—English is the default—and the app translates the talking and plays it aloud on the phone. The person holding the phone responds; this response is translated and played through the earbuds. Google

and pits them against each other in a digital cat-and-mouse game. Both networks are trained on the same data set. One, known as the generator, is tasked with creating variations on images it's already seen—perhaps a picture of a pedestrian with an extra arm. The second, known as the discriminator, is asked to identify whether the example it sees is like the images it has been trained on or a fake produced by the generator—basically, is that three-armed person likely to be real? Over time, the generator can become so good at producing images that the discriminator



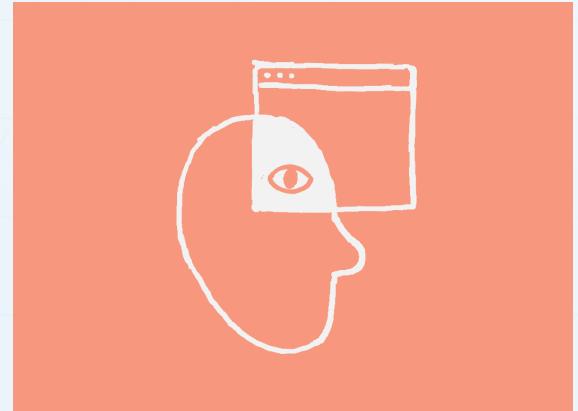
Translate already has a conversation feature, and its iOS and Android apps let two users speak as it automatically figures out what languages they're using and then translates them. These earbuds help overcome the language barrier prevalent even in this increasingly global world. Pixel Buds split the interaction between the phone and the earbuds gives each person control of a microphone and helps the speakers maintain eye contact since they're not trying to pass a phone back and forth.

Pixel Buds show the promise of achieving mutually intelligible communication between languages in close to real-time. And fortunately for us, no fish required.

Perfect Online Privacy

It is sad to say that we live our day to day lives in the fear of clicking the wrong button which might lead to an invasion of our privacy or not being able to trust which sites we can give our personal information to. But thanks to our Computer Scientists, we now have the ability to prove that we are over 18 without revealing our date of birth. This limits the risk of a privacy breach or identity theft.

The tool is an emerging cryptographic protocol called zero-knowledge proof. Much of the credit for a practical zero-knowledge proof goes to Zcash, a digital currency that launched in late 2016. Zcash's developers used a method called a zk-SNARK (for "zero-knowledge succinct non-interactive argument of knowledge") to give users the power to transact anonymously. That's not normally possible in Bitcoin and most other public blockchain systems, in which transactions are visible to everyone. Though these transactions are theoretically anonymous, they can be combined with other data to track and even identify users. For banks, this could be a way to use blockchains in payment systems without sacrificing their clients' privacy. Last year, JPMorgan Chase added zk-SNARKs to its own blockchain-based payment system. For all their promise, though, zk-SNARKs are computation-heavy and slow. They also require a so-called "trusted setup," creating a cryptographic key that could compromise the whole system if it fell into the wrong hands. But researchers are looking at alternatives that deploy zero-knowledge proofs more efficiently and don't require such a key.



Hopefully, these advancements have influenced your outlook on technology in a better and positive way. Now it's your turn to blow minds!

- Arunima S, CSE , III Year

Chandrayaan-2: Sky is the limit

The lander of Chandrayaan-2 is named Vikram after Vikram A. Sarabhai, the father of the Indian Space Programme. It is designed to function for one lunar day, which is equivalent to about 14 Earth days.

FACTS

The moon. It has been the greatest source of curiosity since man first looked up to the sky. Now, years later, after numerous space expeditions carried out worldwide, there are still big questions to be answered about Earth's natural satellite.

In an effort to aid with this quest, India has launched its own mission, Chandrayaan-2 to explore the previously unventured south pole of the moon. In a mission that is being hailed as groundbreaking and work of pure Mechanical and Aerospace genius, let's see what makes ISRO's Chandrayaan-2 so unique. The lunar mission comprises of an Orbiter, to spend a year orbiting the moon from a distance of roughly 100 kilometers, a Lander, dubbed 'Vikram' after Vikram Sarabhai who is regarded as the father of India's space program and a Rover, named 'Pragyan' meaning 'wisdom' which would run on solar power.

Achieving a soft landing on the moon is a feat of significant difficulty, as only the US, Russia and China have been able to accomplish this so far. Chandrayaan-2 would represent India's first soft landing on the surface and it would be the first spacecraft to touch down near the moon's south pole.

The significance of the South Pole is heightened, as there are multiple suggestions that there may be traces of ice in craters, which would be of great interest as the idea of inhabiting the moon in the future seems to be gaining more and more attention. With the help of cutting-edge technology such as CLASS to detect and measure metals, XSM to measure solar radiation and Infrared Spectroscopy to study water molecule distribution, Chandrayaan-2 is well-equipped to provide conclusive evidence.

Another interesting facet of Chandrayaan-2 is the duration of the mission. Unlike most lunar missions, the process involved here was rather lengthy. The first launch was on July 22, from the Satish Dhawan Space Centre located in Sriharikota. It then spent a long time, 23 days, orbiting the Earth and gradually raising altitude. Only on August 14 did it make its way out of the Earth's orbit and set its sight onto

the moon. This seemingly slow nature of the mission was due to the power of the launching rocket, GSLV Mk-III. The mission was also unmanned, making it additionally challenging as the entire path needed to be pinpoint accurate. Overcoming this and managing to derive a mission plan that would work out with these stipulations was truly commendable.

August 20 saw a significant moment, as the spacecraft successfully executed a Lunar Orbit Insertion (LOI) maneuver, entering the moon's orbit. The next steps involved the detaching of 'Vikram' from the orbiter and attempting the soft landing.

All of India was glued to television screens past midnight as 'Vikram' began its descent towards the moon. It wasn't smooth sailing, however, as just moments before landing, communications were lost with the Lander. ISRO's chief K. Sivan confirmed the issue and stated the probable cause to be a 'hard landing'. This heartbreak could be felt across the nation and in what was arguably the most heart-warming video of the year, Prime Minister Narendra Modi was seen consoling the distraught K. Sivan.

All is far from over, though, as the mission was deemed to be '95% successful' as the orbiter was in position and relaying feedback. Also, when all hope seemed lost, the Orbiter located 'Vikram' on the surface and performed thermal scans on the Lander. This gives a renewed belief as attempts are being made to restore communications and proceed with the mission. Whether the mission can be revived or not, there is no denying that this ambitious attempt was a solid effort and is a valuable data set and base for future expeditions, such as the proposed Gaganyaan project in 2022. ISRO can hold its head up high and look forward to what could be a historic decade of space exploration for the country.

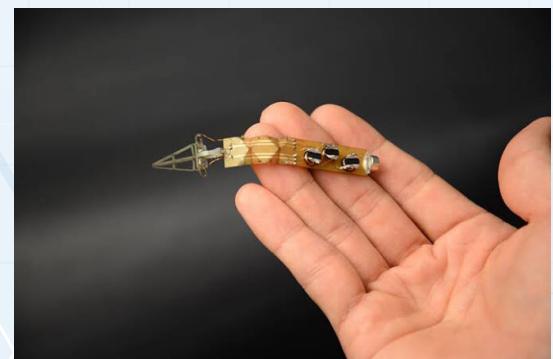
- Akshit Kalantri, Mech , IV Year

Janus Particles in Biomedical Applications

Janus particles, which are named after the two-faced Roman god Janus, have two distinct sides with different surface features, structures, and compositions. This asymmetric structure enables the combination of different or even incompatible physical, chemical, and mechanical properties within a single particle. Much effort has been focused on the preparation of Janus particles with high homogeneity, tuneable size and shape, combined functionalities, and scalability. With their unique features, Janus particles have attracted attention in a wide range of applications such as in optics, catalysis, and biomedicine. As a biomedical device, Janus particles offer opportunities to incorporate therapeutics, imaging, or sensing modalities in independent compartments of a single particle in a spatially controlled manner. This may result in synergistic actions of combined therapies and multi-level targeting not possible in isotropic systems. The latest advances in employing Janus particles include therapeutic delivery carriers, *in vivo* imaging probes, and biosensors.

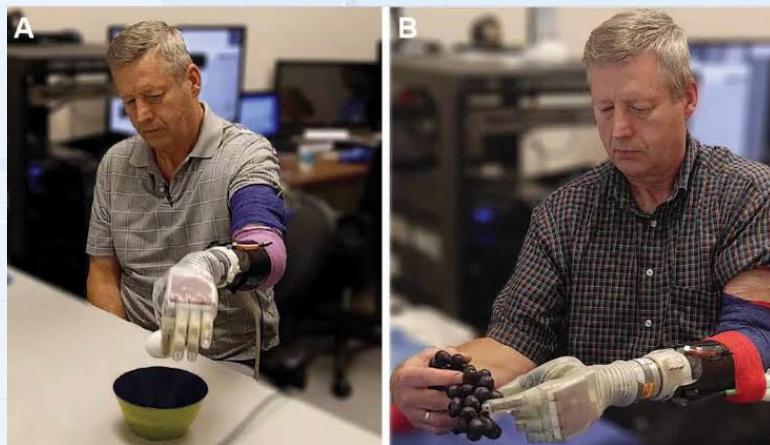
Multifunctional metallic backbones for origami robotics

Origami robots can be formed by tightly integrating multiple functions of actuation, sensing and communication. But the task is challenging as conventional materials including plastics and paper used for such robotic designs impose constraints to limit add-on functionalities. To install multifunctionalities to the system, scientists must typically include external electronics that increase the weight of the robot. In a recent study



now published on Science Robotics, Haitao Yang and colleagues at the interdisciplinary departments of Chemical and Biomolecular Engineering, Biomedical Engineering and Electrical and Computer Engineering in the U.S. and Singapore, developed a graphene oxide (GO)-enabled templating synthesis process to produce reconfigurable, compliant and multifunctional metallic backbones. The backbones formed the basis for origami robots coupled with built-in strain sensing and wireless communication capabilities. Using the GO method, the researchers formed complex noble metal origamis as structural replications of paper templates.

The Star Wars-inspired ‘LUKE Arm’ - Prosthetic arm that detects touch



In a breakthrough development from the University of Utah, a team of biomedical engineers have created a prosthetic arm that could restore the sensation of touch to amputees. Powered by a myriad of electrodes implanted into the muscles and connected to the brain, the high-tech prosthetic prototype has already proved successful in human clinical tests.

Keven Walgamott, an amputee who lost his left hand to an electrical accident almost two decades ago, was one of the first patients to test the prosthetic. Thanks to the inclusion of bionic fingers that can be controlled by the brain, Walgamott was able to successfully pick up a raw egg without cracking the shell, as well as carry out other complex hand movements.

The team was led by Gregory Clark, Biomedical Engineering Associate Professor at the University of Utah. He pioneered the development of the LUKE Arm, which is named after the robotic hand gifted to Luke Skywalker in Star Wars: The Empire Strikes Back. By implanting electrodes into the muscles of amputees, Clark and his team were able to send signals to the brain and recreate the way a human hand touches and feels objects.

“We changed the way we are sending that information to the brain so that it matches the human body,” explains Jacob George, co-author of the study and biomedical engineering doctoral student at the University of Utah. “And by matching the human body, we were able to see improved benefits,” he adds. “We’re making more biologically realistic signals.”

- Anjana A, BME

New and Interesting, aren't they?

1. Technology-Fueled Medicine and Smart Drugs

Medicine helps alleviate medical issues, but only when you remember to take it. Smart drug technology is already available to help with exactly that. In 2017, a smart pill was introduced that alerts patients via an iPad that it's time to take the medicine. If a patch the patient wears on the abdomen fails to pick up a signal that the pill has been taken, the patient receives an alert.

Common Smart Drugs

- Racetams
- N-phenylacetyl-L-propylglycine ethyl ester
- Afinils
- Amphetamine
- Selegiline Hydrochloride
- Desmopressin
- Ergoloid mesylate
- Vinpocetine
- Nicergoline

© www.medindia.net



Another new smart pill is currently in development that can be used to diagnose and treat disease, as it is traceable on its journey throughout the body. This microdevice could monitor brain, blood and gastrointestinal tract activity, measuring factors like temperature and pH levels and delivering that information to doctors.

2. Artificial Intelligence in Biomedical

Google's DeepMind project is using both biomedicine and informatics to analyze data related to kidney disease patients in Britain's National Health Service. This project is designed to identify potential



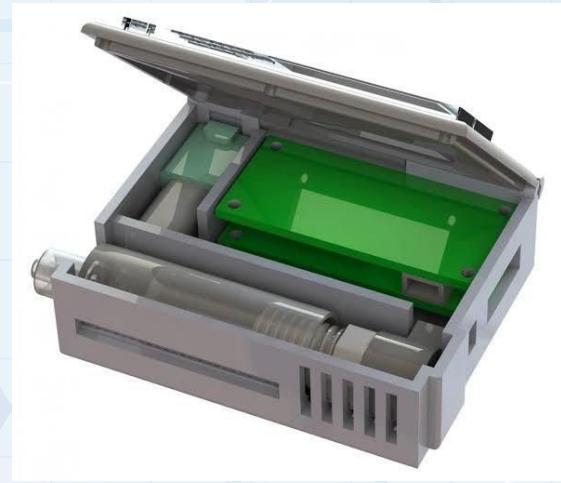
complications, as well as effective protocols, sooner than might be determined by providers, using the intelligence gained via data. Should this project prove successful, similar AI and machine learning projects will be launched worldwide.

3. Wearable Sweat-Sensor Informs Athletes of Water and Electrolyte Loss

A group of researchers have recently developed waterproof, bandage-like sweat sensor that tells the wearer when to replenish electrolytes and fluids. This innovative patch collects and analyzes athlete's perspiration as they exercise in any environment – even while swimming.



4. Wearable Device Precisely Detects Cancer Cells in Blood



University of Michigan researchers have recently created a wearable device that can continuously collect and examine circulating tumor cells (CTCs) in the blood. These cancer cells are typically obtained via blood samples to provide a biomarker for treatment, but this wrist-worn prototype could potentially screen patients' blood for a few hours to obtain only the CTCs of interest.

- Prasidha Prabhu, BME , II Year

PROJECTS

IT initiative information objectives knowledge goals resources implementation critics process requirement concept ability

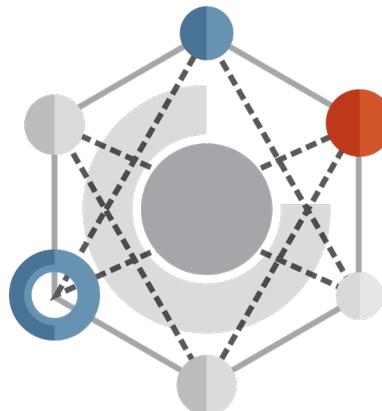
DEPARTMENT OF CHEMICAL ENGINEERING

MY INTERNSHIP AT IFB INDUSTRIES

The work of a Chemical Engineer is multi-faceted. As Process Engineers in evolving plants, they work on a variety of fields. These fields are now diverse and include optimization, control, design as well as environmental engineering. Working in research labs can provide insights into how testing and evaluation at a bench scale can be reproduced at commercial scale to produce chemicals and products of economic and scientific value.

IFB Industries is a well-renowned maker of home appliance products. The company has recently diversified their business, starting a line of products called IFB Essentials. These include various detergents (customized for their top and front load machines), dish cleaning liquids as well as stain removers (petroleum solvent based). I had the opportunity to serve as a research intern in the summer of 2018, at their R and D facility. The facility, situated

in Verna Industrial Estate, Goa is next to their manufacturing plant, where their washing machines are made. An initiation to their manufacturing facility helped gained a bird's eye view of their production process. After this, various assignments related to quality testing and performance evaluations were undertaken.



One of the undesired consequences of using a washing machine with hard water supply is the buildup of limescale. A 'Descaling' product is often used to cleanse washing machines. A crucial parameter in studying the efficacy of such products is the percentage of Citric Acid content. A simple titration analysis can provide this data. This helps the research team ensure that the product is adhering to expected performance norms.

Global stain cloth strips (comprised of standard stains like coffee, tea, cocoa,

lipstick etc.) are used in washing machines. Measuring reflectance data from a spectrophotometer pre and post wash gave an indication of detergent performance.

Formulation of detergents is an important aspect of this business. Various components are added in the course of making a detergent, such as cationic and anionic surfactants, chelating agents, optical brighteners, colors and perfumes, solubilizers and neutralizers.

Other work involved carrying out tests to evaluate the efficacy of detergents. This can be evaluated through the means of measuring percentage anionic content. This is a measure of the amount of surfactants that are available in the detergent to affect cleaning action. Titration tests can give a measure of the same. This was carried out on IFB's products, and also those made by their competitors. Such data is useful for a research team in improving their product formulations.

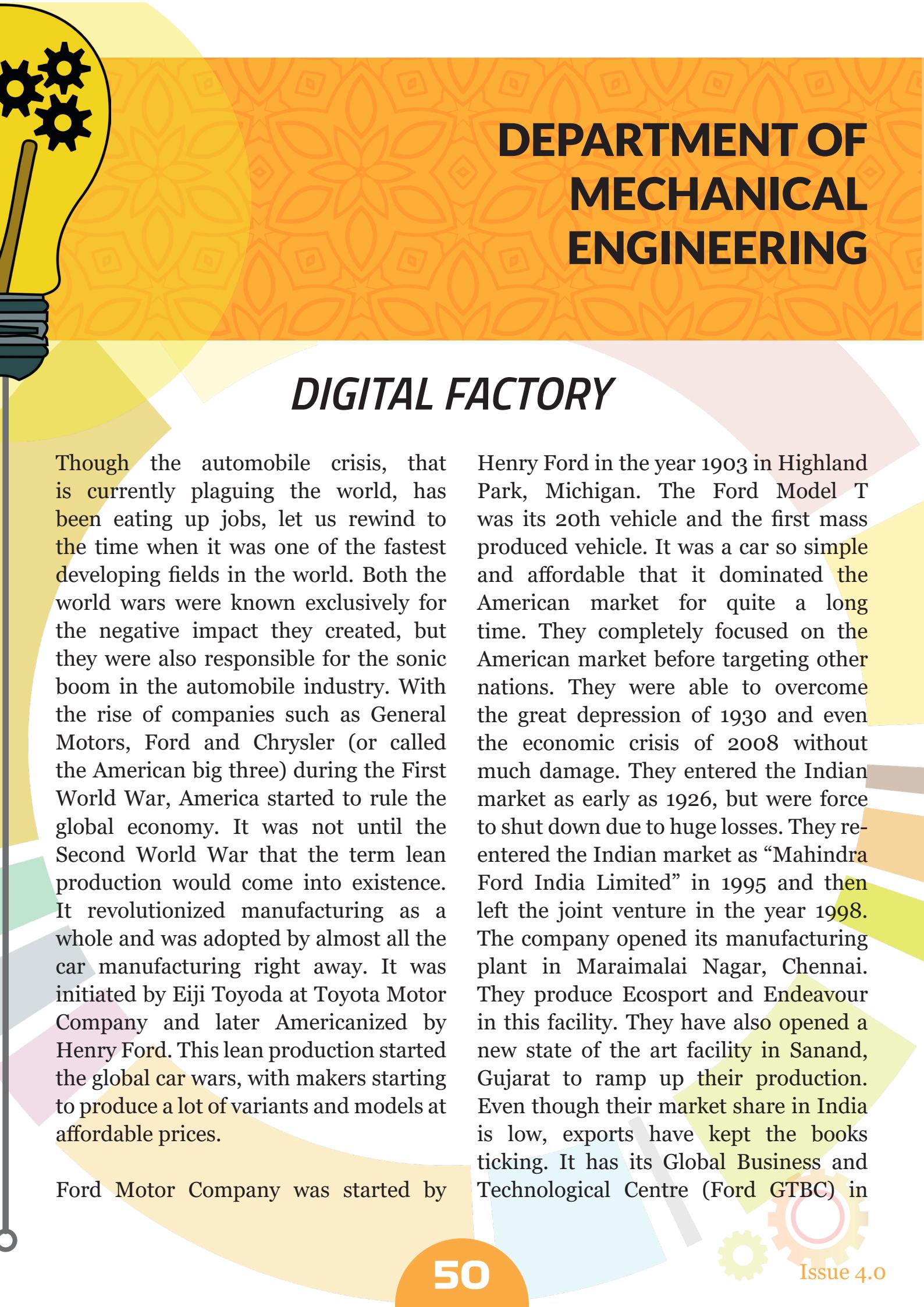
Anirudh Madhavan
Chemical Department

Work was also carried out into evaluating the performance of optical brighteners. But I also got the opportunity to learn about the other aspects of the business, such as packaging, scale-up and distribution. I learnt that industries are comprised of teams that work in collaboration with one another. For example, a product formulated by the scientists must meet viscosity specifications of the packaging team. (Viscosity varies with temperature, the flow of a washing liquid could be different in Kashmir and Chennai).



Spending close to three and a half weeks in their facility in Goa allowed me the opportunity to gain insights into research approaches firms take to solve real-time problems. A combination of technical skill, knowledge and innovation is required; along with careful consideration of the implications on cost and profit.





DEPARTMENT OF MECHANICAL ENGINEERING

DIGITAL FACTORY

Though the automobile crisis, that is currently plaguing the world, has been eating up jobs, let us rewind to the time when it was one of the fastest developing fields in the world. Both the world wars were known exclusively for the negative impact they created, but they were also responsible for the sonic boom in the automobile industry. With the rise of companies such as General Motors, Ford and Chrysler (or called the American big three) during the First World War, America started to rule the global economy. It was not until the Second World War that the term lean production would come into existence. It revolutionized manufacturing as a whole and was adopted by almost all the car manufacturing right away. It was initiated by Eiji Toyoda at Toyota Motor Company and later Americanized by Henry Ford. This lean production started the global car wars, with makers starting to produce a lot of variants and models at affordable prices.

Ford Motor Company was started by

Henry Ford in the year 1903 in Highland Park, Michigan. The Ford Model T was its 20th vehicle and the first mass produced vehicle. It was a car so simple and affordable that it dominated the American market for quite a long time. They completely focused on the American market before targeting other nations. They were able to overcome the great depression of 1930 and even the economic crisis of 2008 without much damage. They entered the Indian market as early as 1926, but were forced to shut down due to huge losses. They re-entered the Indian market as "Mahindra Ford India Limited" in 1995 and then left the joint venture in the year 1998. The company opened its manufacturing plant in Maraimalai Nagar, Chennai. They produce Ecosport and Endeavour in this facility. They have also opened a new state of the art facility in Sanand, Gujarat to ramp up their production. Even though their market share in India is low, exports have kept the books ticking. It has its Global Business and Technological Centre (Ford GTBC) in

ELCOT, Sholinganallur.

The Ford GTBC has a lot of technical and non-technical departments under it. One of the tech departments is the Digital Factory, where a group of nine of us had the opportunity to complete our summer internship for the duration of three months. We were working extensively on digitizing an existing plant into a 3D CAD model with the help of point cloud data. Point cloud data is a collection of millions of points in space having a RGB value and a co-ordinate. It can be obtained if we scan the factory with a laser 3D scanner. We used this data to reverse engineer the entire plant on Autodesk Inventor. We also had to do the Mechanical Electrical and Plumbing (MEP) for the plant on a different tool called Autodesk MEP. Both were done separately and then collaborated together at the end. We were reverse engineering China's engine plants and Cleveland Engine Plant in the US. We were also responsible for creating trusses, columns, conveyors and designing non-productive parts over the period of the project. This data was really helpful for the company to have a digital replica of the entire plant and was helpful to design a new assembly line or plant if needed.

Pranaav Sankar
Mechanical Department
IV Year



We had a number of sessions conducted by members from other departments such as ergonomics, throughput simulations, CAE, data analytics, machining, car body design and leadership sessions on emerging technologies. These sessions were really helpful in understanding what the company is currently working on, and also gave a good exposure on the industry and its requirements. From a visit to Maraimalai Nagar, we saw a lot of the components that we modelled in real time. Ford had no hierarchy system which enabled an employee to meet the top-level managers without having to cross boundaries. Also being a process based company, they valued the process more than anything. The biggest takeaway that we had from this 3 month project is the way one must present himself

to others. Being new to the corporate environment, we initially struggled to get use to the surroundings, but when we saw how the employees presented themselves, we were able to observe and catch up in speed. I would like to thank the Department of Mechanical Engineering and the HRs at Ford GTBC for letting us being a part of this project. This was a great learning experience and is a monumental start to our career.



Go Further

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CRYPTOPHARMACEUTICALS:

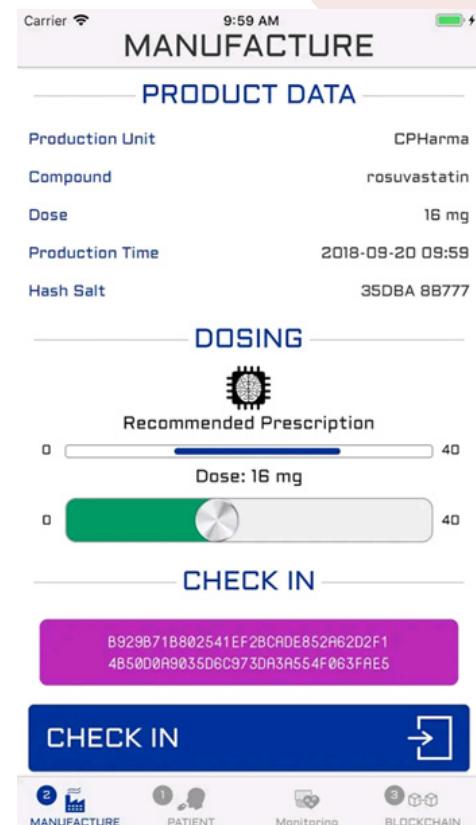
Increasing the Safety of Medication by Blockchain of Pharmaceutical Products.

Concepts like Blockchain, Machine Learning, Internet of Things and Big Data are soon finding their way into the medicine cabinet.

Researchers at the University of Copenhagen have developed a prototype of an app that prescribes the optimal dose of medicine for the individual patient, as well as prevent counterfeit products. The core of the group is the concept of cryptopharmaceuticals. Cryptopharmaceuticals is a blockchain-based system that would store location coordinates of a particular object/medicines and track it as it progresses through the supply chain.

The app is called ‘MedBlockChain’. With the app, patients will be able to scan a medication and receive confirmation that it is a genuine product and not a fake item. Getting to know the authenticity of the prescribed medicine is a very serious problem in countries with regulatory agents that are not structured.

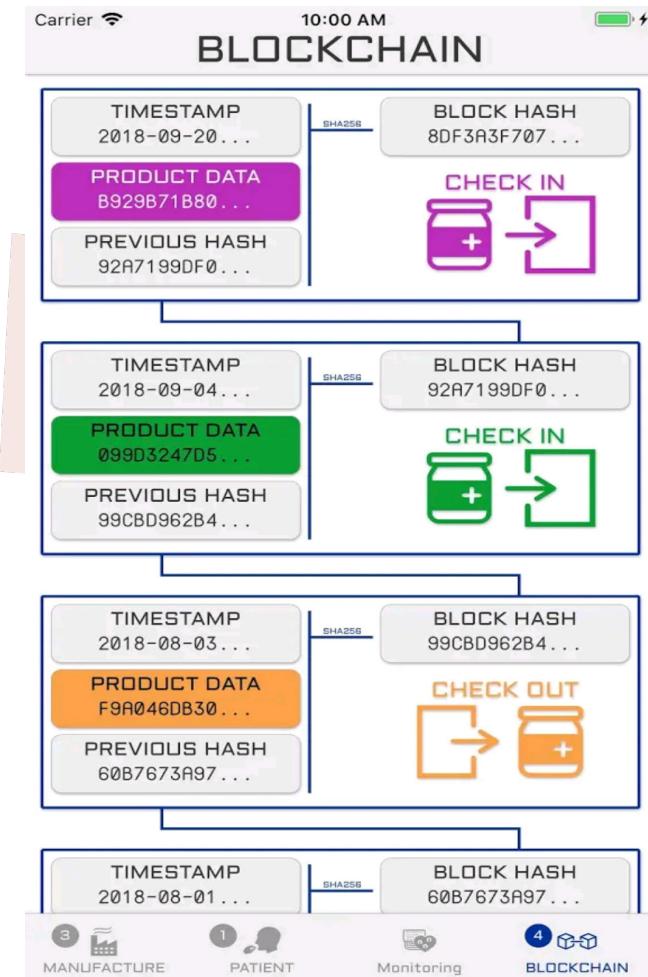
The app also has a feature where patients can provide access to a range of personal data -- everything from heart rate monitor watches, pedometers and internet-connected bath scales to genetic profiles, screen time and social media usage -- all contributing with knowledge that can enable computer systems based on artificial intelligence to gradually pin down the optimal dose for each patient.



So when these important and personal data is given to the app, the question of data security is raised and it is a very serious one. To guarantee data security, the app uses the blockchain technology, which is probably best known in connection with the cryptocurrency Bitcoin.

A blockchain is a time-stamped series of an immutable record of data that is managed by a cluster of computers not owned by any single entity. Each of these blocks of data is secured and bound to each other using cryptographic principles i.e. chain. The blockchain is the very definition of a democratized system. Since it is a shared and immutable ledger, the information in it is open for everyone to see. SO anything that is built on the blockchain is transparent and everyone who is involved with it is responsible for its actions. With blockchain, information -- or data blocks -- are linked in a chain that cannot be changed without simultaneously altering all other links of information in the chain. Thus, all changes will be detected and may be traced. If something looks suspicious, the system can also generate an alarm.

An example, when a patient who scans the QR code on his/her medication may be alerted by the system if the codes do not match with the one the pharmacy has entered into the system. Also, the pharmaceutical company will be alerted if the unique code is registered more than once. Similarly, an absence of registrations may form the basis for alarms as it may reveal that the patient



is not taking his or her medication as planned. This information may, for example, be shared with the patient's doctor or relatives.

The technology of blockchain is being put to various different use here and it definitely creates an impact on the society.

The app 'MedBlockChain' is available on the PlayStore.

Hariny G
Computer Science Department
IV Year

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CIAO ARRIVEDERCI!!

The Godfather is not just supposed to be watched, it is meant to be felt in the bucolic setting of SICILIA di CATANIA.



I embarked on a beautiful journey to intern at one of the best institutes in Italy! This journey has taught me how to work on a new projects and given me a lot of life lessons. University of Catania , Italy is a premier institution in Sicile. One of the oldest universities in the country, it is located in the slopes of lava with a bayview. Apart from holding the title of being one of the best educational institutions in the country, it also offers a culturally dynamic environment for the students. It is known for providing high quality teaching and fostering innovative research in various fields. It was indeed a great pleasure for me to work with Professor Laura Galluccio from the department of Electrical, Electronic and Computer Engineering(Dipartimento di Ingegneria Elettrica Elettronica e Informatica) in the field of Underwater Networking.

I had an opportunity of experimenting in the field of Reinforcement Learning and also analyse its applications in various fields. Reinforcement learning is a subset of machine and deep learning which works on rewards rather than data sets. The project required me to set up nodes underwater and facilitate packet transmission with least loss. Also, there was a great flavour of cryptography added to this. The network should function well in times of jamming attacks and find alternate paths to respond to the same. My professor was really helpful in giving me critic suggestions to alter the path and prototype of research to ensure 100 percent accuracy. This project was a great personal success as it allowed me to experiment with different softwares and simulations.

The duration of the internship was an absolute blast since 8 of my college mates accompanied me as fellow interns. Travelling from North to South of Sicile and basking in placid beaches was a definite highlight! Travelling across the country, meeting people with diversified cultures and tasting the country's authentic food were few of the many things that made this trip a memorable one.

Travel and learn and trust that it will be the most adventurous experience ever! This not just steepens your learning curve but also adds amazing memories to your scrapbook.

Shivani Sundar

Electronics and Communication Engineering Department

IV Year

E
X
C
E
L
L
E
N
T
R
E
S
E
A
R
C
H

CIVIL ENGINEERING

Challenges pertaining to sustainability in practice

The definition of “Sustainability” as per the Brundtland Commission in 1987, which is widely accepted by the United Nations states: “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”

Sustainability, as emphasized in this very definition, is a complex phenomenon to achieve—especially when social motives interplay in housing. In a country like India with diverse population and with varied levels of income, it is tough to break down how much of the ‘need’ and how little of the ‘want’ of every variant class can lead to a “proper sustainable design”. Not just that, interestingly some theorists reasoned that only when the need goes hand in hand with other non-material factors like education, social relationship, recreation, the establishment of social equality, with decent lives and higher standards of living for all, could be fulfilled.

Another challenge of its own in creating sustainable buildings in India is in the outlook of the developers in embracing new technologies of the market. For instance, when a breakthrough for rapid and mass affordable housing projects was identified in the form of Glass Fibre Reinforced Gypsum (GFRG) Panels, it is yet to be incorporated widely in the mainstream construction market even after 20 years.

GFRG technology is essentially composed of gypsum plaster with glass fibres that are about 300-350 mm length and are randomly distributed inside the panel skins and ribs during manufacturing. The content of fibre is 0.8 kg/sqm. The manufacture of GFRG panels involve usage of recycled industrial by-products of gypsum as raw materials and thus, there is significant reduction in usage of carbon-intensive cementitious materials and steel.

GFRG panels are stable and

resistant against vertical loads. These panels are earthquake resistant as well due to voids present in them, that dissipate the seismic energy resulted from the internal friction movement. It has better fire resistance than a conventional building as well.

Despite promising a quick, cost and energy-efficient, a moderately high earthquake-resistant model, the problem associated with GFRG is the lack of technical know-how and the fact that laborers still have not acquired the skill in construction of GFRG houses. Also, the residents' apprehension of living under an 'experimental' choice of building material is also another reason for GFRG not being applied on a large scale, despite being approved as a green material by the United Nations Framework Convention on Climate Change (UNFCCC) under Clean Development Mechanism (CDM).

Therefore, a transition of the economy to knowledge-based service industry needs to be looked

into, to tap the available resources to its maximum potential and meet the extensive demands. Social acceptance and technical know-how are equally serious challenges that must be looked into. Therefore, the grave concerns that lie ahead can be redressed mainly with the incubated technologies gaining prevalence in the market and with adequate skill-sets. Meanwhile, the progressing knowledge (deriving from education and awareness) towards the sustainable goals must attend to every section of society, through the socially beneficial indicators stressed upon by certain theorists to promote holistic attempts towards conservation. Apart from that, a proper realization of one's necessities in accordance with the weight of the societal concerns and its constant upgradation requires significant awareness-building and social responsibility at the micro-levels and unanimous contributions from all walks of life.

J. Gokul Krishna and Roshan.R
Civil Engineering,
4th Year

ITC Maurya, in Delhi, is one of the first and largest eco-friendly buildings to have been built in India. It recycles 90% of its waste.

ONWARDS AND UPWARDS

Snippets from the world of Aerospace...

Aerospace has always been one of the most ingenious and relentlessly progressing industries over the many years. It has seen countless innovations and developments come to light, and still strives to better its technology and shape it in a way that is achievable most efficiently. A few of the exceptionally revolutionary innovations in the recent times that are expected to break the cliché of the conventional wisdom regarding aerospace technology among people are discussed below.

Craft-to-craft communication is undeniably the most crucial innovation in terms of safety that has been successfully brought into the existence of an idea. This is more essential for the flights and units working in defence programs where communication plays a truly significant role. It allows the pilots to communicate and estimate the distance between them to prevent them from crashing into each other. This shall allow multiple drones to work together, offering the desired precision and strength in numbers to avoid collisions. The U.S. Air Force is seemingly at the pinnacle of this technology's success, as it recently released a video showing how tiny drones will soon be able to similarly swarm

together for the purposes of surveillance, targeting, and assassination. Beyond just defence aircrafts, this technology has been reported to eventually work its way into passenger planes too.

There has always been a dire need to upgrade the software systems that are being used for multifunctional aspects in aerospace industries. These software upgrades shall play a pivotal role in ensuring the safety of the aircrafts at every stage of their flight. It can also improve the efficiency of landings resulting from improved communications of aircrafts with the ground control. Currently, the aircrafts follow a stair-step landing process. But with new systems and upgraded communications, they will be able to follow a continuous landing approach henceforth. The smooth and continuous descent will allow every flight to be shorter by two or so minutes and save about hundreds of gallons of gas.

One another revolutionary development that has been under investigation is electric propulsion systems. NASA has been researching the implications of this shift toward Distributed Electric Propulsion for several years now.

The lightweight and compact electric motors have intrigued engineers to rethink the use of large conventional engines being mounted under the wings. The compactness of electric motors has made it possible for small propulsion units mounted throughout the wing span. This shall offer uniform weight distribution and unprecedented flexibility in managing the airflow over the wing's control surfaces. Admittedly, it will take decades to bring electric propulsion to anywhere close to domestic and large-scale passenger aircrafts, but the emergence of hybrid propulsion systems is likely to onset soon enough.

The innovations and developments brought in by Industry 4.0 have also managed to impact the aerospace industry in its manufacturing and MRO operations. Plane makers Boeing and Airbus, which are basically known for their extensive use of CAD systems are using VR systems in their design processes, and are integrating significantly diverse varieties of sensors and incorporating

IoT into their products for real-time applications and refining their customer support. Blockchain technology is in talks of being introduced in the manufacturing sector to resolve one of the most common problems in the industry: counterfeit parts and products. Blockchain technology in the Aerospace industry can help root out fraud and counterfeiting by creating an easily traceable chain of custody across supply chain of sellers and customers.

Researches by Capgemini has reported that as a whole, the aerospace industry is far ahead of other major industries, including automotive, energy and utilities, consumer goods, and life science or pharma, with over 60% of companies reporting they have a smart manufacturing plan in place. Despite such an appreciably significant head start, aerospace industries constantly try to progress in every aspect of growth possible, as the stakes and the scope of development have been equally high and will continue to be.

T.Anirudhh Sai
Mechanical Engineering,
4th Year

The use of rocket engines for aircraft propulsion opened a new realm of flight to the aeronautical engineer. Robert H. Goddard, an American, developed, built, and flew the first successful liquid-propellant rocket on March 16, 1926.

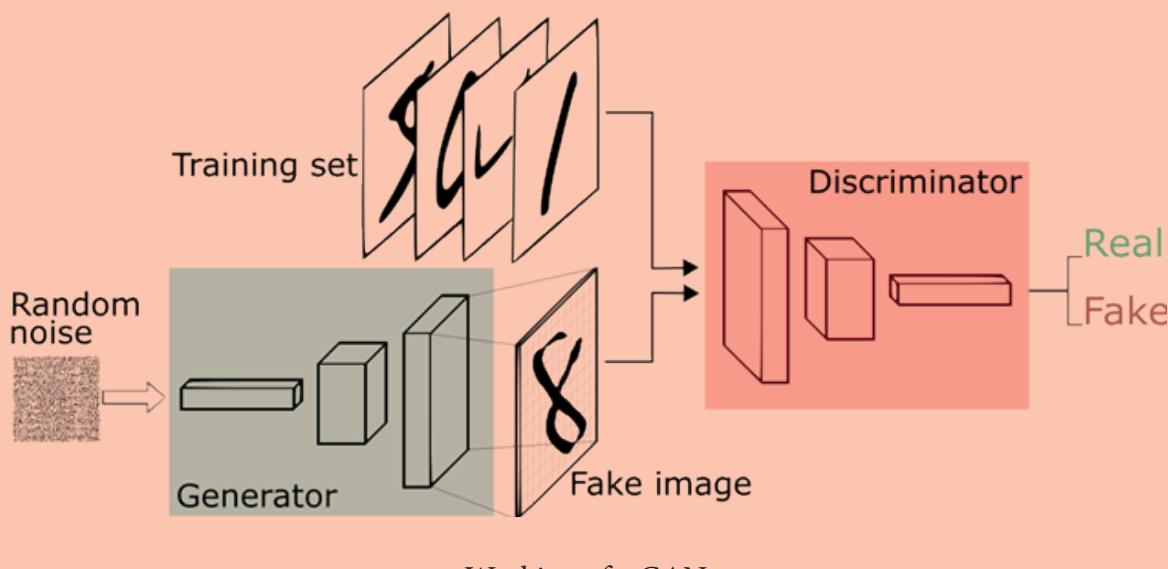
COMPUTER SCIENCE AND ENGINEERING

GYAN on GAN

Bringing creativity and originality to machines has always been a thing of fascination for us over time. The field of AI has always been motivated to aid computers to make humanlike decisions using their cognitive abilities. A Generative Adversarial Network or GAN is a subject that has cropped up recently within the last 10 years and has risen to the forefront in the development of AI. Let us see what makes GAN so unique.

So, what is a GAN?

GANs are generative models devised by Goodfellow et al. in 2014. They work on the principle of generating and discriminating the inputs. The word “Generative” in the term points to the property of the GANs to create something of its own using a training dataset by leveraging the power of Machine Learning.



The network learns to generate from a training distribution through a 2-player game. The two entities are Generator and Discriminator. These two adversaries are in constant battle throughout the training process.

As you can identify from their names, a Generator is used to generate real-looking data and the Discriminator's job is to identify which one is a fake. This data can be anything ranging from text, audio, images or even video files. The entities are in a constant battle as one(Generator) tries to fool the other(Discriminator), while the other tries not to be fooled. The steps are repeated several times and in this, the Generator and Discriminator get better and better in their respective jobs after each repetition.

Why do we need GAN?

The need for the development of GAN's arose from the fact that even most mainstream Neural Networks could be fooled by adding a little bit of noise in the training data. This has a huge impact when training models with a limited amount of data. This also increases the occurrences of false positives, reducing the overall accuracy. GAN's help overcome this by being able to generate additional data and improves the accuracy in spotting and overcoming noise in data.



AI-Generated Face Images from the Nvidia Project

Where do we apply GAN?

You might remember the wave of news that came in late December 2018 about realistic-looking images generated by an AI. Well, that was GAN! If you review the above snippet from the project, it's easy to see why this was such a big story. The images were indistinguishable from the real-life pictures of a human face. This was a project undertaken by researchers at Nvidia to define a Style based Architecture for GAN's.

Another popular application of GAN is FaceApp, a popular mobile application capable of producing realistic aging, de-aging and gender-swapping pictures of people apart from many other filters using just a single selfie.



Sample Poem from the PoemPortraits project

Pioneering research has been going on in the field of Text generation using GAN's where computers are able to write poems and stories when fed in with the related parameters such as emotion and characterization. Google AI's recent PoemPortraits project is a good example of this. Music Generation and Video Generation have also been a popular application of GAN.

In a nutshell, GAN's are an innovative and upcoming area of research that has high implications on an industry level and is touted to be one of the next big things in the area of Deep Learning and Artificial Intelligence.

**A.Aashish
Computer Science Department,
4th Year**

Speech Processing

Google assistant can differentiate a user's voice from another user. It can understand many languages (English, French, Spanish etc.) the user speaks and in any accent. This is the most brilliant feature of Google assistant, processing the speech signal and providing useful information based on the user's request. This is all because of an important concept called "Speech Processing". In this section, you will be introduced to speech processing based on the valuable information provided by Dr. R. Rajavel, Associate Professor, Department of ECE. Speech processing is the study of speech signals and their processing methods for a specific application. Speech processing can be considered as a special case of digital signal processing, applied to speech signals. Sometimes, it can also be regarded as the intersection of digital signal processing and natural language processing.

Speech processing includes speech acquisition, manipulation, storage, transfer, and output of speech signals. Speech processing technologies are used for digital speech coding, spoken language dialog systems, text-to-speech synthesis, and automatic speech recognition.

Speech signal processing finds lot of applications in various fields such as speech coding (compression of speech signals for telecommunication), speech Synthesis (from text to speech), speech recognition (extracting the linguistic content of the speech signal), speaker recognition (recognizing the identity of speakers by their voice), speech enhancement (improving intelligibility or perceptual quality of speech signals) and many others. To study speech signal processing, the basic knowledge of signals and systems and digital signal processing is required. Professionals in speech processing are in a high demand by the IT industries. Well known tech giants such as Samsung Electronics, Microsoft, Qualcomm, IBM, Amazon, Facebook, NVIDIA, Apple, Motorola Solutions, SoundHound Inc, Samsung Semiconductor Inc, UST Global, Avrio Corporation, Unitedhealth Group, Digit Insurance and many more recruits speech

processing professionals as Speech Scientist, Audio DSP Engineer, Data Science Manager (NLP and Speech), Deep Learning / Machine Learning Engineers, Research Scientist (Speech, Audio, NLP and AI) and Applied Scientist – Speech (ASR, NLU, and NLP).

Many core IT companies provide internship opportunities to speech processing professionals. For example, Amazon provides internships to researchers currently pursuing Masters or Doctoral degrees and looking to launch their careers in Automatic Speech Recognition (ASR), Machine Translation (MT), Natural Language Understanding (NLU), Dialogue Management (DM), Text-to-Speech (TTS), and Audio Signal Processing (ASP), in order to provide the best-possible experience for their customers.

Speech signal processing is of course an interdisciplinary domain, which may be related to human computer interfaces, telecommunications, assistive technology development, Audio mining, security (e.g., biometrics, forensics), natural language processing, machine learning, phonetics, human computer interaction and perceptual psychology and many more Dr. Rajavel and his team are working on monaural speech separation using computational auditory scene analysis and image processing techniques. Monaural speech is a special case where the speech signal is recorded using single microphone. Monaural speech separation is a challenging problem in speech processing since only single microphone recording is available. In a natural environment, the speech signal is accompanied with multiple sound sources. The processing of separating the target speech from the monaural noisy mixture remains a challenging task for machines.

However, human beings have an inherent capability to separate the speech from the noisy mixture. Researchers made tremendous effort to develop speech separation systems that automatically separate the target speech from the monaural noisy mixture. However, these systems have failed to distinguish the target speech from the noisy mixture. Still researches are trying to develop an effective speech separation system to separate the target speech from the noisy mixture as human beings. Monaural speech separation systems have many potential applications in the field of automatic speech and speaker recognition (ASR), speaker identification, audio information retrieval, automatic music transcription, digital content management and hearing aids. Over the last few decades, various methods have been proposed for monaural speech separation. Some of the commonly used methods are speech enhancement, subspace analysis, model-based and CASA.

However, all these methods require some form of prior knowledge about speech or interference, whereas in real scenario, prior knowledge of speech or interference is not possible. Hence, researchers started to use auditory scene analysis (ASA) proposed by Bregman for monaural and binaural speech separation which does not require any prior knowledge about speech or noise. The computational implementation of the speech separation systems based on ASA is generally called as computational auditory scene analysis (CASA). The research work uses this CASA and image processing techniques jointly to separate the target speech from the monaural noisy mixture and improves the speech quality and intelligibility.

We thank our professor, Dr.R.Rajavel, for sparing his valuable time to give useful information on speech processing. We are sure this article would be of great use to all the students.

Chinmayi Udhayabhaskar
Electronics and Communcation Engineering Department
IV Year

Brain Organoids produced in Labs

Scientists at the University of California, San Diego have managed to develop models of brain organoids in vitro. These organoids emit waves that are similar to human preterm infants. Head Scientist of the project, Allyson Moutri predicts organoids with much more sophisticated circuitry in about 10 years.

The scientists used pluripotent stem cells from human skin to prepare the organoids. These stem cells were kept in an artificially designed environment that mimicked the developing conditions for the human brain. This resulted in the pea-sized organoids with neuron, synapse and ever-growing circuitry that emitted a single frequency brain wave in two months. After ten months, these organoids were able to emit waves of all frequencies an infant would. This however plateaued and is attributed to the fact that human brains have input which further develops the synapse and networking in the brain.

The researchers attached the organoid to spider robots to get input and scientist Moutri said given time these organoids can even develop a conscious. This is an important breakthrough in the field of medicine and biomedical engineering because scientists often trace the cause of several syndromes to brain development, including epilepsy, autism and schizophrenia. These neural network malfunctions may even be fixed.

“The organoid is still a very rudimentary model – we don’t have other brain parts and structures. So these brain waves might not have anything to do with activities in real brains,” Muotri explained. “It might be that in the future, we will get something that is really close to the signals in the human brains that control behaviours, thoughts or memory. But I don’t think we have any evidence right now to say we have any of those.”

Elakiya Sivakumar
Biomedical Engineering
II Year

OUR SPONSORS

mr.
cooper®
CHANGING THE FACE OF HOME LOANS





Get Into The Most Exciting Role

- ▶ **Cybersecurity Courses**
- ▶ **Faculty Development Programs**
- ▶ **Cybersecurity Lab Setup**
- ▶ **Cybersecurity Internship Programs**
- ▶ **Center of Cybersecurity Excellence**

**From the House of K7 Computing
Global Leader in Cybersecurity**

www.k7academy.com

K7 Academy
a unit of K7 Computing Pvt.Ltd
4th Floor, Tower - B, Tek Meadows
No. 51, Rajiv Gandhi Salai, Sholinganallur
Chennai - 600 119, Tamil Nadu, India.
Phone : +91 9791033133 | E-mail: info@k7academy.com





invente 4.0

EXPLORE THE INFINITY





invente 4.0

EXPLORE THE INFINITY